

Are Gender Differences more Pronounced Across the Earnings Distribution?

by

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Abstract

This study examines gender differences in the earnings of young adults in the mid 1980s. We revisit this issue from a different perspective: we determine changes in the gender gap in the middle, the tails, and the variability of the earnings distribution. We employ data from a longitudinal, nationally probability sample of high school seniors: the National Longitudinal Study of high school seniors in 1972 and the 5th follow-up in 1986. We compute the average differences using effect size estimates expressed in standard deviation units. Differences in the tails and the variability are computed using number and variance ratios respectively. Our results indicate that there is a rather large and significant gender difference in earnings favoring males. The gender gap is more pronounced for Whites and Hispanics and less extreme for Blacks. Controlling for employment selection, education, occupation, marital status, family size, and hours of work we find that the gender gap in earnings closes somewhat. Nonetheless, the adjusted gender gap is still large and significant.

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Introduction

The study of gender differences in labor market outcomes, such as earnings, has gained ample attention in economics and the social sciences. Gender differences in earnings, favoring males on average, have been researched and documented, and frequently debated in the literature. There is empirical evidence that the gender gap is decreasing over time.

The quality of the empirical evidence has not always been very strong for two main reasons. First, typically, the samples of numerous studies on gender differences in earnings are not representative of any well-defined population. Many studies use localized/convenience samples that are often times difficult to generalize to the nation as a whole. In addition, it is plausible that much of the previous research suffers from selection bias, which constitutes an important threat of external as well as internal validity (Cook & Campbell, 1979). The main argument against selection bias is that a sample of specific individuals might not be representative of the population of individuals with the same characteristics. It is impossible to know the extent of bias in these samples; however, it is conceivable that because of selection bias the estimates reported in most of the previous studies might be very different from their “true” population parameters. In other words, it is likely that some of the results reported are positively or negatively biased.

Second, the overwhelming majority of previous studies on gender differences in earnings has exclusively examined and reported group differences in means (central tendency of the distribution of earnings). Differences in the

variability of the earnings distribution for females and males are often times overlooked. Nonetheless, it is conceivable that the variance of the earnings distribution for females may be different that the variance of the earnings distribution for males. Notice that differences in the variance of the earnings distribution are important, since they may explain differences in the tails of the earnings distribution. For example, if males and females have comparable average earnings, but the distribution of earnings for males has a larger variance, then one would expect to find higher proportions of males in the lower and the upper tails of the earnings distribution. In addition, gender differences in the extremes (upper and lower tails) of the earnings distribution are seldom documented in the literature. It is, however, quite plausible that gender differences in the tails of the earnings distribution may be quite different qualitatively than differences in the middle of the distribution. For example, males may be overrepresented in the top 10% of the earnings distribution compared to females, a byproduct of over-concentration of men in highly paid jobs. Similarly, females may be over-represented in the lower tail of the earnings distribution. These differences may not necessarily be in congruence with gender differences on average.

This study employs the base year and follow-up sample of a national probability sample of high school seniors, and examines gender differences in earnings across the whole distribution of earnings for young adults. Specifically, we use information from the fifth follow-up of the National Longitudinal Study (NLS:86) of the High School Class of 1972. These rich data allowed us to

examine the labor market performance of individuals some 14 years after high school graduation, avoiding transitional labor market effects.

Because of the use of national probability samples our results are more likely to have higher external validity (generalizability) and be more resilient to threats of selection bias. We examine gender differences in earnings for young adults in the mid 1980s across the whole distribution of earnings. Specifically, we determine the gender gap in earnings on average (central tendency), in variability (variance), and extreme values of income (either very high, top 5, 10%, 25% or very low income, bottom 5, 10%, 25%). We also examine gender differences in earnings adjusting for social class (education and occupation), marital status, hours of work per week, number of children, and sample selection, since such covariates can play a very important role in the gender gap. For example, controlling for education and occupation should in principle equate individuals for skills, knowledge, and productivity, preferences in the labor market (Mutari & Figart, 2003). Similarly, controlling for marital status should adjust for differences due to household responsibilities. In addition, taking into account how many hours each individual works per week adjusts for differences in labor force participation. Also, family size is likely to motivate men to join the labor force and women to stay at home or work part time. Finally, adjusting for sample selection is also necessary, since workers are not a random sample of the population.

We also examine gender differences in earnings across the entire distribution of earnings within three major race/ethnic groups: Blacks, Hispanics,

and Whites. This allows us to determine whether the gender gap differs across the three main race/ethnic groups.

The remainder of this study is structured as follows. First, findings of previous research on gender differences in earnings are summarized. Second, we outline our data and the methods we used to analyze them. Third, the results of the analysis are presented, and fourth, concluding remarks are drawn.

Related Literature

In a nutshell, the culprits of gender wage differentials rest upon 3 broad theories: (i) differences in human capital (mainly education and experience), which lead to differences in productivity, which are in turn reflected in differences in wages, (ii) discrimination, and (iii) differences in employment types, job levels, industry, and/or labor market segmentation.

Research on the gender earnings gap has documented that, on average, the earnings of white males are considerable higher than those of females. The finding that on average white males earnings are considerably higher than those of white females and other race/ethnic groups is well established in the labor economics literature (Carnoy, 1996; Durden & Gaynor, 1998). In addition, these gender and race/ethnicity earnings differentials persist even after adjusting for human capital and labor market characteristics. In fact, there is some evidence that gender effects are substantially larger than race/ethnicity effects (Durden & Gaynor, 1998; Corcoran & Duncan, 1979). A recent study provides further

support to this notion by reporting that schooling is important in explaining race but not gender earnings differentials (England et al., 1999).

Nonetheless, the hourly wage difference between men and women has narrowed between the mid 1970s and the late 1980s (O'Neill & Polachek, 1993). This earnings convergence is oftentimes partly attributed to increases in women's work experience, years of schooling, and other skill acquisition. For instance, Blau and Kahn (1997) postulate that the closure of the gender gap in wages is not only attributed to improvements in women's occupational status and experience, but also to enhancements in women's unmeasured labor skills and/or a decrease in discriminating against them. Blau-Kahn (2001) find that two thirds of this wage gap is due to differences in experience, occupational choice, and industry classification. A rise in relative female productivity and a fall in female discrimination (the residual) have been contributing to the decrease in the gender wage gap. Moreover, the black-white as well as the Latino-white wage differential has decreased between 1940 and 1980 (Smith & Welch, 1986, 1989). Indeed, blacks and Latinos made large gains in education and earnings during the last 50 years. To conclude, even though gains in schooling contributed in reducing the minority-white earnings gap, this contribution is rather small, especially for blacks.

Earnings are a function of health, education, training, and experience in the labor market. According to human capital theory, education enhances labor market productivity and, therefore, earnings (Becker, 1964). In fact, education is pivotal to human capital formation, and investments in human capital have been

hypothesized to yield sizable economic and social rates of return. The main hypothesis is that higher levels of education correspond to higher levels human capital, which in turn results in higher labor market performance and higher paying jobs. To that end, we also explore gender differences in earnings controlling for educational attainment. In this study we control for educational attainment using a dummy that takes the value of one if the individual has a college degree or more and zero otherwise.¹

We also examine gender differences in earnings controlling for occupational status. We control for occupational status using two dummies: one for professional and one for white-collar workers. The blue-collar workers category serves as the comparison group. Occupational status is a proxy for choices and preferences in the labor market (Mutari & Figart, 2003). It is also a proxy of the market's evaluation of an individual's skills and potential. We are interested in determining gender differences in earnings net of the effects of occupational status, or examine the gender gap for persons with the same occupational status.

Finally, previous findings have reported that marital status is an important correlate of earnings. Specifically, marital status signals productivity to the labor market and affects potential tenure on the job, hence positively affecting earnings. It has been repeatedly found that in the U.S. married men earn substantially more than unmarried men even after controlling for human capital and race (Bartlett & Callahan, 1984; Korenman & Neumark, 1991). More recent studies have replicated these findings in other developed countries suggesting

¹ Note that we start with a homogeneous sample of high school seniors.

that the married-unmarried men gap in average earnings might be ubiquitous (Schoeni, 1994). In fact, Schoeni reported that wage differences are evident even among those men who are currently not married. For example, separated or widowed men earn significantly more than men who are never married. For that reason, we also examine gender differences in earnings net of the effects of marital status. We control for marital status using a dummy that takes the value of one if the individual is married or living under common law and zero otherwise.

Method

Data Set

We employ a rich, longitudinal, and representative sample of individuals who were high school students in 1972 and wage earners in 1986. Specifically, we draw upon the National Longitudinal Study (NLS) of the High School Class of 1972 and the fifth follow-up in 1986. NLS-72 is a national probability sample of high school seniors designed to represent all twelfth graders enrolled in public or private American high schools in the spring of 1972 (Riccobono et al., 1981). These students were followed for 14 years after high school, and, thus, they were resurveyed in 1974, 1975, 1977, 1980, and 1986. We employ data collected during the base-year survey in 1972 and the fifth follow-up in 1986. Our final sample includes all individuals who were present in 1972 and in 1986 and were not in the military.

This dataset is unique in providing valuable information on the educational attainment, occupational status, and employment outcomes of young adults in

1986. The longitudinal feature allows us to follow individuals 14 years after their high school graduation and examine their labor market performance during their prime time in the labor market. In addition, because we are also looking at students who have been in the labor market for more than a decade we avoid any biases from school to work transitions. Typically, individuals tend to be more settled and change jobs less often after the first decade of employment.

Using the NLS fifth follow-up made it possible to examine gender differences in employment outcomes for young adults in their mid 30s at their peak of labor force participation and remuneration. Our sample incorporated individuals with various levels of education to ensure the inclusion of all persons who reported positive earnings in 1986.

Our dependent variable is annual wages in 1985. Note that we use the term wages and earnings interchangeably in this study. Our independent variables include educational attainment, occupational status, weekly hours of work, family size (e.g., number of children), and marital status. We also control for selection bias in earnings using the Heckman method.

Analysis

Since workers may differ from non-workers in unobservable ways we adjust our models for possible selection bias. Specifically, following Heckman (1979) we use a probit model that estimates possible selection in the labor force for the entire sample. Our predictors for the labor force participation equation include family background, educational attainment, marital status, student status,

and non-labor income (income from interest, social security and veteran benefits, welfare, unemployment compensation, gifts, scholarships, etc). We hypothesize that a college degree will increase the probability to work, while high non-labor income will decrease the probability to work by increasing the reservation wage. In addition, we expect married individuals to have a higher probability to work since marital status has been shown to signal labor force attachment and higher productivity in the labor market affecting potential tenure on the job (e.g., Korenman & Neumark, 1991). Note that while this argument holds for men it does not hold for women.

From the probit model we calculate the so-called inverse Mill's ratio or λ , which we take into account when computing gender differences in earnings to adjust for possible non-random selection of workers. Note that all analyses are corrected for selection in the labor force, and therefore all results presented in this study in the following section are adjusted for potential selection bias. For identification purposes, the earnings adjusted equation includes occupational status and hours of work.

A standard method to assess group differences in means is to compute effect sizes. An effect size is simply a standardized mean difference between two groups. To examine average gender differences in earnings we calculate effect sizes by subtracting the estimated national mean of earnings for males from that for females and dividing by the estimated national standard deviation (SD) of earnings for the entire distribution with both gender groups included. We use sampling weights to construct estimates for the national means and the

national standard deviations for both groups. This is because of the standardization the effect sizes are expressed in standard deviation units, which makes them easier to interpret. For example, an effect size of one would indicate that the average difference in earnings between females and males is one standard deviation. Negative values indicate that the difference favors males, while positive values indicate that the difference favors females. We compute unadjusted gender differences in earnings as well as gender differences adjusted for important predictors.

Differences in the variability of the distribution of earnings among groups are gauged using the variance ratio (Hedges & Nowell, 1999). This ratio is simply the square of the ratio of the standard deviation of the earnings distribution for females to that of the earnings distribution for males. A ratio greater than one indicates that the variance of the female distribution of earnings is larger than that of male, while a ratio smaller than one indicates that the variance of the male distribution of earnings is larger. Again, we compute unadjusted gender differences in earnings variability as well as gender differences in variability adjusted for important predictors.

Group differences in the upper and the lower tails of the earnings distribution are estimated by the ratio of the proportion of individuals who are females, to that of males in a specific location of the distribution (Hedges & Nowell, 1999). To accomplish that, we first constructed national percentiles for the entire distribution of earnings with all groups included using weights. Then, we estimate the proportion for individuals for each group who fell in the

predefined national percentiles. For example, we estimate the proportion of females who were in the upper 5, 10% of the total distribution of earnings. In other words, we assess the proportions for each group (females and males) that had extreme values of earnings (either too high or too low). We estimate these proportions for the bottom and the top 25, 10, and 5% of the entire distribution of earnings. Once the proportions for each group were estimated, we construct a ratio of the estimated proportion for females to the estimated proportion for males. If the representation of the two groups is the same in the specific percentiles of the distribution, one would expect to obtain ratios of one. Ratios greater than one indicate over-representation of females over males for a specific percentile, and similarly, ratios smaller than one indicate under-representation of females over males.

Gender differences in earnings are also examined adjusting for social class (occupational status and educational attainment), marital status, family size, and weekly hours of labor force participation. We hypothesize that such variables can play an important role in gender differences in earnings. In particular, we expect that the gender gap in earnings will be smaller after having taken into account these covariates. To carry out the analyses for the adjusted variance and number ratios, we first regress the earnings on our set of covariates. The residuals obtained from the regression served as the new/adjusted distribution of earnings net of the effects of the predictors. Finally, we employ the same methods to examine unadjusted and adjusted gender

differences in earnings for Blacks, Hispanics, and Whites. Again, note that all analyses are also corrected for selection in the labor force.

Results and Discussion

Descriptive Statistics

Table 1 summarizes the descriptive statistics for selected variables in the base year and fifth follow-up samples of NLS for the entire sample by gender and race. Overall, our sample consists of 51% women and 49% men. Nearly 10% of our sample are Blacks, 3% are Hispanics, and 82% are Whites. Except for the Hispanics, the gender ratio is maintained across the races. On average, women in 1986 while in their early thirties earn 40% less than men (nearly \$11,000 less annually). When we break annual earnings² by race, we see that Black women earn almost as much as White women, while minority men, Blacks in particular, earn 20% less than White men. While Hispanic women earn more than White women Hispanic men earn nearly 10% less than White men. These statistics also show that although a smaller percentage of women than men have finished college in 1986, still ¼ of them have acquired a college degree. The majority of both women and men in our 1986 sample are married but a higher percentage of women than men are in the divorced category. Overall, the majority of individuals in our sample are white collar workers. However, women are mainly in white collar or professional jobs (80%), while men are mainly in blue collar jobs (45%).

 Insert Table 1 Here

² We are using annual earnings because our data does not have information on hourly wages.

Primary Analyses

The average gender gap for all individuals in the sample in earnings was a little less than 3/4 of a standard deviation (SD) favoring males in 1986 (see Table 2). This is a rather large difference according to standard criteria for evaluating effect sizes (Cohen, 1977). Controlling for important covariates closed the gender gap somewhat (about 9%), but the average gender gap in earnings is still large. This is rather surprising since one would expect the adjusted gender gap in earnings to be smaller.

Similar patterns are observed for the majority group (Whites) and the two minority groups (Black, Hispanics). The gender gap for Whites in 1986 is comparable to that for all individuals (about $\frac{3}{4}$ of a standard deviation). Controlling for important covariates the gender gap in earnings closes a little (about 9%). The gender gap for Blacks in 1986 is about one half of a standard deviation, nearly 30% smaller than the gender gap in earnings for whites. However, when we control for important covariates the gender gap in earnings is augmented a little (about 15%). The adjusted gender gap in earnings for Blacks is somewhat smaller (about 9%) than the gender gap in earnings for Whites. The gender gap for Hispanics in 1986 is about 0.65 of a standard deviation, nearly 10% smaller than the gender gap in earnings for Whites, and about 20% larger than the gender gap in earnings for Blacks. However, controlling for important covariates augmented the gender gap in earnings a little (about 7%). The

adjusted gender gap in earnings for Hispanics is somewhat larger (about 5%) than the gender gap in earnings for Whites, and about 15% larger than the gender gap in earnings for Blacks.

Insert Table 2 Here

Table 3 summarizes the unadjusted and adjusted for important covariates gender differences in number ratios in the tails of the earnings distribution for the entire sample and for specific race/ethnic groups. First, we discuss the unadjusted gender differences in earnings. In 1986 there are four to eight times more women than men in very low earning jobs (bottom 10, 5%). In contrast, there are four times as many men than women in very high paying jobs (top 10, 5%). The results for Whites were quite comparable. The gender differences for Hispanics are less extreme, however. About three to four times as many women as men are in the low paying jobs, and about three times as many men as women are in the high paying jobs. Gender differences for Blacks were even less extreme. About two times as many women as men are in the very low paying jobs, and about two times as many men as women are in the high paying jobs. Nonetheless, overall, women are under-represented in the upper tail of the earnings distribution and over-represented in the lower tail. The differences are more pronounced for Whites than for Hispanics or Blacks.

Insert Table 3 Here

The adjusted gender differences in number ratios in the tails of the earnings distribution show different patterns. In 1986 there are nearly four to five as many men as women in very low earning jobs. In addition, there are two times as many men as women in very high paying jobs. The results for Whites and Hispanics are similar. The gender gap is smaller for Blacks as previously. It is noteworthy that in the very high paying jobs there is an equal representation of Black men and women in 1986. Again, the gender differences for Blacks are less extreme.

Gender differences in the variability of the earnings distribution are summarized in Table 4. Overall, the unadjusted earnings distribution for males is much more spread out than that of females. In 1986, the variance of the male earnings distribution is nearly two times larger than that of females. This difference in variability is also evident for Whites in 1996. While similar patterns are observed for Blacks or Hispanics, the differences are less extreme. Typically, across all race/ethnic groups, the male earnings distribution is more spread out than that of the females. Gender differences in the variation of the earnings distribution adjusted for important covariates did not change much. In sum, overall, the adjusted male earnings distribution is more spread out than that of the females.

Insert Table 4 Here

The lambda coefficient is positive and significant in all specifications except for analyses on Hispanics. This indicates that adjusting for selection bias was necessary in these analyses. These results confirm that the workers in our sample are not a random sample and that they come from the upper distribution.

Conclusion

In this study we examine gender differences in annual earnings employing a rich dataset of a representative sample of high school seniors. That is, we start with the same cohort of men and women students in 1972. Using the 5th follow-up we study these individuals 14 years later when they are integrated in the labor force. We explore the gender gap across and within racial/ethnic groups, adjusting for social class (human capital), marital status, family size, weekly participation in the labor force, occupation, as well as for selection in the labor force.

Overall, men earn on average a significantly higher income than women in the 1980s. It is noteworthy, that educational attainment, occupational status, marital status, family size, and weekly participation in the labor force do not have a significant effect on the gender wage gap. While the gender gap becomes somewhat smaller it is still large (larger than one half of a standard deviation).

This indicates that men and women with the same education, occupation, marital status, weekly labor force participation, and number of kids, still earn significantly different incomes. This result holds for our entire samples as well as for the majority and minority ethnic groups. These gender differences are actually much larger than any gender differences observed in student mathematics and reading achievement for high school seniors (Hedges, & Nowell, 1995). However, the gender gap is more pronounced for White workers, less pronounced for Hispanic workers, and even less pronounced for Black workers.

Men are generally over-represented in higher paying jobs (4, 5 times), while women are over-represented in lower paying jobs (5 to 8 times). The adjusted gender gap in the tails of the earnings distribution, however, followed a different pattern for low paying jobs. In fact, the pattern was reversed. Controlling for important characteristics resulted in more men being in lower paying jobs than women (nearly 4 times as many men). Men are still more likely to have higher paying jobs, but the gender gap is now much smaller (one to two times as many men). In high paying jobs the gender gap is almost reduced in half. We observe similar patterns for White, Hispanics, and Black workers. In fact, Black men and women are equally likely to have very high paying jobs when important factors are taken into account. This indicates that our covariates had a larger effect on the gender gap in the high or low income categories than in the middle income category.

It is interesting that the male distribution of earnings is more diverse than that of women. Specifically, the variance of the male earnings distribution is twice

as large as that of females in 1986. This partly explains the under-representation of women in the higher paying jobs. We find that the differences in the variances of the earnings distributions are less extreme when we control for important covariates (especially in the high wage categories). This finding is consistent with previous findings that indicate that male high school seniors have more spread out achievement scores than females (Hedges, & Nowell, 1995).

In sum, our findings indicate large gender differences in annual wages in the 1980s favoring males. Even adjusting for important covariates, the average gender gap in wages does not close significantly. This indicates that there maybe unobservable factors that account for the gender gap.

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Table 1. Arithmetic Means and Proportions for Selected Variables by Gender

<u>Survey</u>	<u>U.S. Population</u>	<u>Female</u>	<u>Male</u>
<u>NLS:86</u>			
<u>Individual Characteristics</u>			
Female	50.9%	-	-
Male	49.1%	-	-
Black	9.7%	11.3%	8.0%
Hispanic	3.3%	3.2%	3.5%
White	82.2%	81.2%	83.2%
Professional	21.2%	23.3%	19.1%
White Collar	46.7%	58.0%	35.7%
Blue Collar	32.1%	18.8%	45.1%
College Degree or More	26.0%	24.7%	27.4%
Single	17.1%	15.3%	18.8%
Married	67.7%	67.9%	67.6%
Divorced-Separated-Widower	10.5%	12.3%	8.6%
Living in Common Law	3.8%	3.8%	3.9%
<u>Annual Earnings</u>			
All Groups	21,754	15,859	26,660
Blacks	18,254	15,811	21,451
Hispanics	20,736	16,315	24,166
Whites	22,316	15,950	27,409

Table 2. Average Gender Differences in Earnings for the Entire Sample and for Different Ethnic/Race Group

Survey	Entire Sample	Blacks	Hispanics	Whites
Unadjusted				
NLS:86	-0.716*	-0.521*	-0.656*	-0.739*
Adjusted ^a				
NLS:86	-0.656*	-0.618*	-0.709*	-0.679*

* $p < 0.05$

a: We adjusted for education, occupation, marital status, number of children, hours of work weekly, and sele

Table 3. Gender Differences in Number Ratios in Earnings for the Entire Sample and for Different Ethnic/Race Groups

Survey	Bottom 5	Bottom 10	Bottom 25	Top 25	Top 10	Top 5
NLS:86						
Unadjusted						
Entire Sample	8.07	4.27	3.34	0.28	0.24	0.26
Blacks	1.91	1.42	1.71	0.41	0.46	0.56
Hispanics	4.39	3.14	2.80	0.31	0.36	0.37
Whites	8.47	5.12	3.25	0.28	0.24	0.20
NLS:86						
Adjusted ^a						
Entire Sample	0.22	0.29	0.56	0.77	0.67	0.53
Blacks	0.67	0.60	0.75	0.79	0.66	1.01
Hispanics	0.24	0.44	0.74	0.96	0.76	0.56
Whites	0.21	0.27	0.54	0.76	0.65	0.51

a: We adjusted for education, occupation, marital status, number of children, hours of work weekly, and selection

Table 4. Gender Differences in Variability in Earnings for the Entire Sample and for Different Ethnic/Race Gr

Survey	Entire Sample	Blacks	Hispanics	Whites
Unadjusted				
NLS:86	0.53	0.87	0.84	0.53
Adjusted ^a				
NLS:86	0.46	0.89	0.63	0.45

a: We adjusted for education, occupation, marital status, number of children, hours of work weekly, and sele